Quality Assurance
Software Development Processes

Part II - Lecture 3

The FBI Virtual Case File

- Database application developed by the FBI between 2000 and 2005
- To replace legacy "stovepipe" systems
- Cost: nearly $170 million
- Abandoned before deployment
- Reasons (according to the FBI):
  - Incomplete/changing requirements
  - Management problems
  - Lack of software engineers
  - Changing team
  - Underestimated complexity

Why?

http://www.fbi.gov/news/testimony/fbis-virtual-case-file-system

Today's Outline

SE Software Engineering
The University of Auckland

- Software Development Processes (Recap & Overview)
- eXtreme Programming (XP)
- Rational Unified Process (RUP)

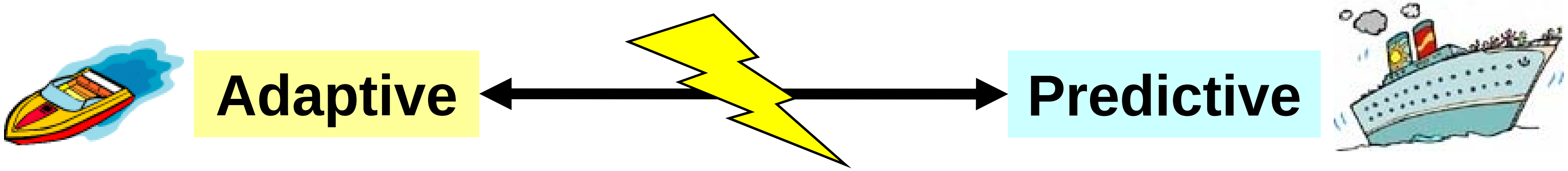
Software Development Processes

No challenge is too great
if you plan ahead.
And have pointy ears.

What is your CMM level today?

Level	Characteristics	Key process areas
1 Initial	Unstable environment Unpredictable, ad hoc	None
2 Managed	Management processes Based on experience	Requirements management, project planning, tracking and oversight, CM
3 Defined	Standardized, docu-mented process Effective SE practices	Process definition & focus, training program, SE, peer review
4 Quant. Managed	Measurement program Predictably high quality	Quantitative process management, software quality management
5 Optimizing	Process improvement Analyze defects Disseminate experience	Technology & process change management, defect prevention

Adaptive vs. Predictive Processes



Adaptive

Predictive

- Lightweight, 'agile'
- Control by feedback
- Many short iterations (weeks)
- Small scale (<10 developers)
- Face-to-face communication
- Code- & people-centric
- Egalitarian

- Problems:
  - Long-term results hardly predictable
  - Needs good project foundation
  - Cowboy-coding chaos

- E.g. XP

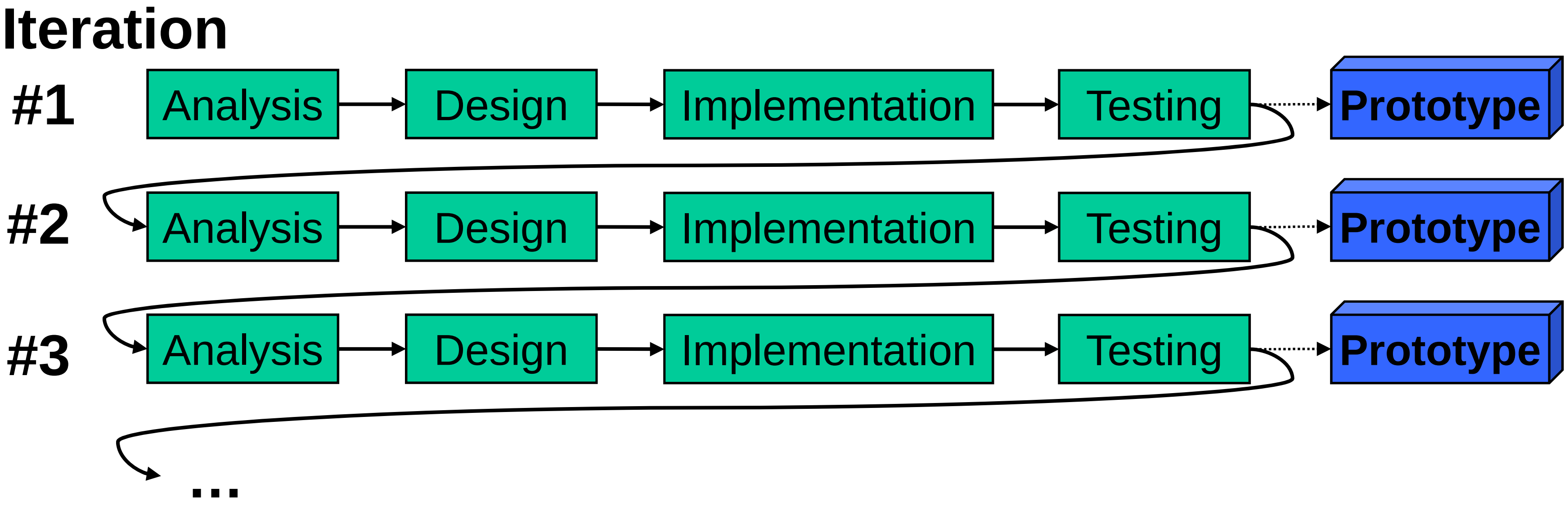
- Heavyweight, 'traditional'
- Control by planning
- Few long iterations (months)
- Large scale (>30 developers)
- Written documents
- Rule-centric
- Authoritarian

- Problems:
  - Inflexible with changing requirements
  - High integration and testing effort
  - 'Control freak' bureaucracy

- E.g. waterfall, RUP

Agile Software Development

- Evolved in mid 1990s as part of a reaction against heavyweight methods
- Many short iterations (weeks), 'prototyping':



- Control by feedback: reevaluation & revision of project after each iteration

eXtreme Programming (XP)

"I don't have anything against education
- as long as it doesn't interfere with your thinking."

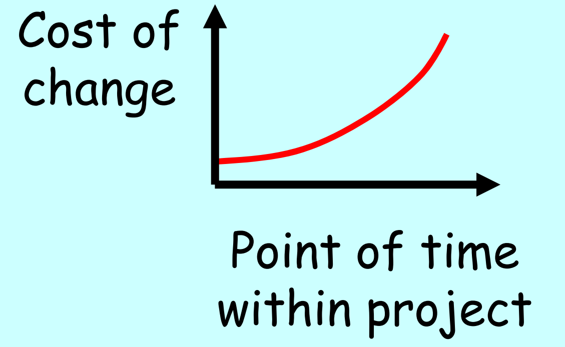
XP Overview

„Instead of cowboy coders we have software sheriffs; working together as a team, quick on the draw, armed with a few rules and practices that are light, concise, and effective.“
(James D. Wells, extremeprogramming.org)

- XP=eXtreme Programming:
  Nomen est omen, a code-centered approach
- **XP culture**: not just about getting work done
- Set of day-to-day **best practices** for developers and managers that encourage and embody certain values
- 5 values, 12 practices/rules

The 5 XP Values

1. Communication
   - Teamwork: consistent shared view of the system
   - Open office environment: developers, managers, customers
   - Verbal, informal, face-to-face conversation
2. Feedback
   - Find required changes ASAP to avoid cost
   - From the customer, through early prototypes & communication
   - Testing, code review, team estimates



3. Simplicity
   - Build the simplest thing that works for today
   - No work that might become unnecessary tomorrow
   - Simple design easier to communicate
4. Courage
   - To change and to scrap, “embrace change”
   - Better change now (cheaper)
   - Never ever give up!
5. Respect your teammates and your work

The 12 XP Practices

Fine scale feedback

1. Pair Programming
   Programming in teams of two: driver and navigator
2. Planning Game: method for project planning with the customer
3. Test Driven Development
   - First write test cases, then program code
   - For each defect, introduce new test case
4. Whole Team: teamwork of customer, developer/manager

Shared understanding

5. Use an agreed Coding Standard
6. Collective Code Ownership
   Everybody is responsible for and can change all code
7. Simple Design
8. System Metaphor
   Consistent, intuitive naming of program parts

The 12 XP Practices

Continuous process

9. Continuous Integration
   - Work with latest version
   - Integrate local changes ASAP
10. Refactoring
    - Improve design whenever possible
    - Remove clutter & unnecessary complexity
11. Small Releases

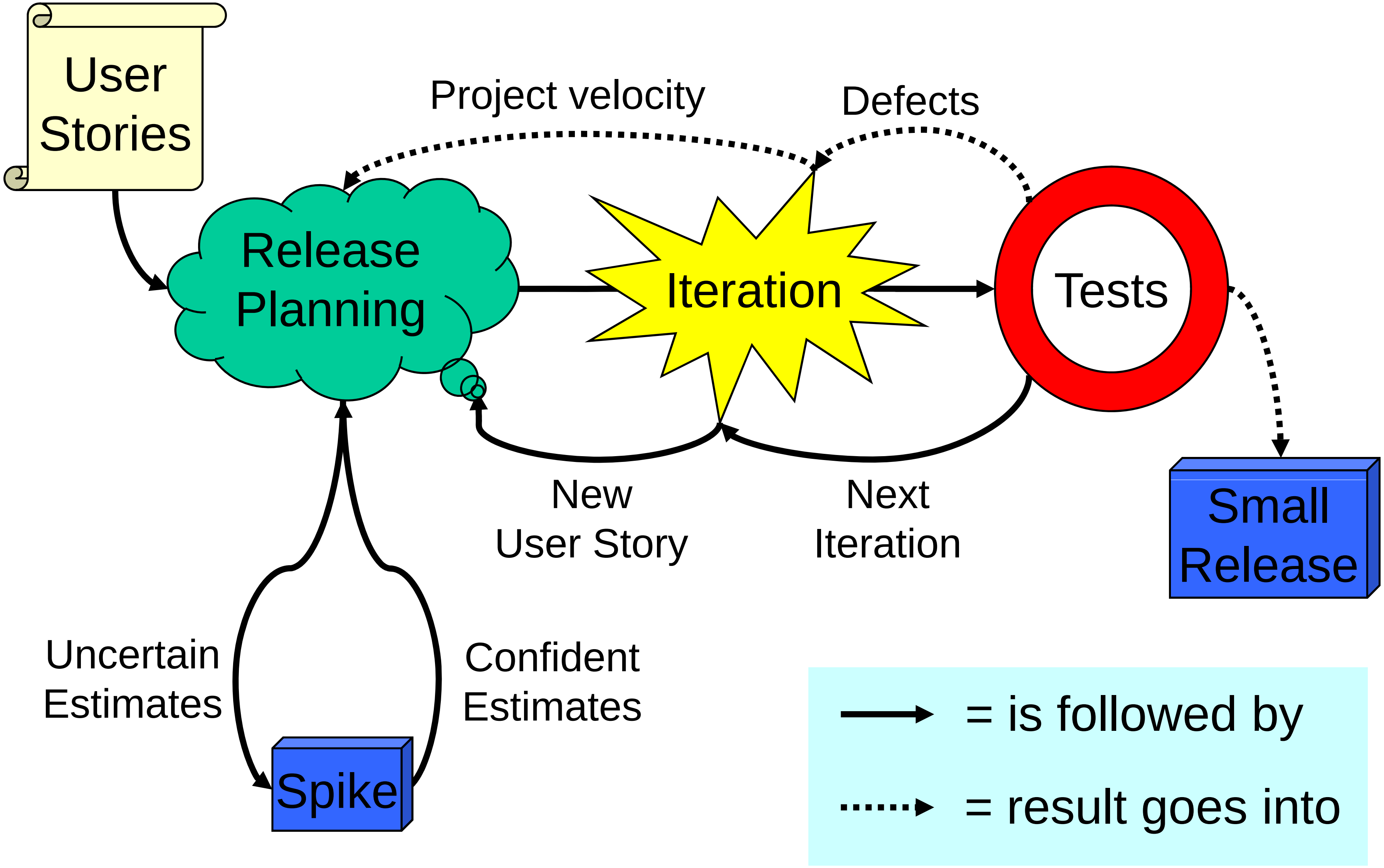
Programmer welfare

12. Sustainable Pace
    No Overtime – change timing or scope instead

Some XP Terminology

- User story
  - Things the system needs to do for the users
  - Written on a card in a few sentences
  - Should take 1-3 weeks to implement
- Release: running system that implements important user stories
- Spike
  - Small proof-of-concept prototype
  - Explores the feasibility of an implementation approach
- Iteration
  - Phase of implementation, 1-3 weeks long
  - Consists of tasks, each of which is 1-3 days long
- Project velocity: used to estimate progress
  - Either #stories / time (time)
  - Or time / #stories (scope)

XP Workflow Overview



User Stories

Release Planning

Project velocity

Defects

Iteration

Tests

New User Story

Next Iteration

Small Release

Uncertain Estimates

Confident Estimates

Spike

→ = is followed by

⇢ = result goes into

XP Criticism

- Relies on **on-site customer**
  - Single point-of-failure (-> source of stress, lack of technical expertise)
  - May not be representative for all users (-> user conflicts)
- **Unstable Requirements** because of informal change requests instead of formal change management (-> rework, scope creep)
- **Lack of documentation**, e.g. tests instead of requirements documents
- **Incremental design** on-the-fly (-> more redesign effort)
- **Pair-programming** required
- **Interdependency of practices** requires drastic organizational changes
- **Scalability**? **Distributed development**?

The Rational Unified Process (RUP)

RUP Overview

- Extensible, customizable **process framework**
- Created by the Rational Software Corporation in the 1980s and 1990s, which was sold to IBM in 2003
- Now software process product of IBM
- IBM sells RUP tools, e.g. Rational Method Composer for authoring, configuring and publishing processes
- **Business-driven** development
- Tied to UML
- Heavyweight, i.e. of considerable size, but recent changes influenced by lightweight, agile processes

6 RUP Best Practices: The RUP ABC

Adapt the process

- right-size the process to project needs
- adapt process ceremony to lifecycle phase
- continuously improve the process
- balance project plans and associated estimates with the uncertainty of a project

Balance competing stakeholder priorities

- understand and prioritize business and stakeholder needs
- center development activities around stakeholder needs
- balance asset reuse with stakeholder needs

Collaborate across teams

- motivate individuals on the team to perform at their best
- encourage cross-functional collaboration
- provide effective collaborative environments

The RUP ABC Cont'd

Demonstrate value iteratively

- incremental value to enable early and continuous feedback
- adapt your plans
- embrace and manage change
- drive out key risks early

Elevate the level of abstraction

- reusing existing assets
- leverage higher-level tools, frameworks, and languages
- focus on architecture

Focus continuously on quality

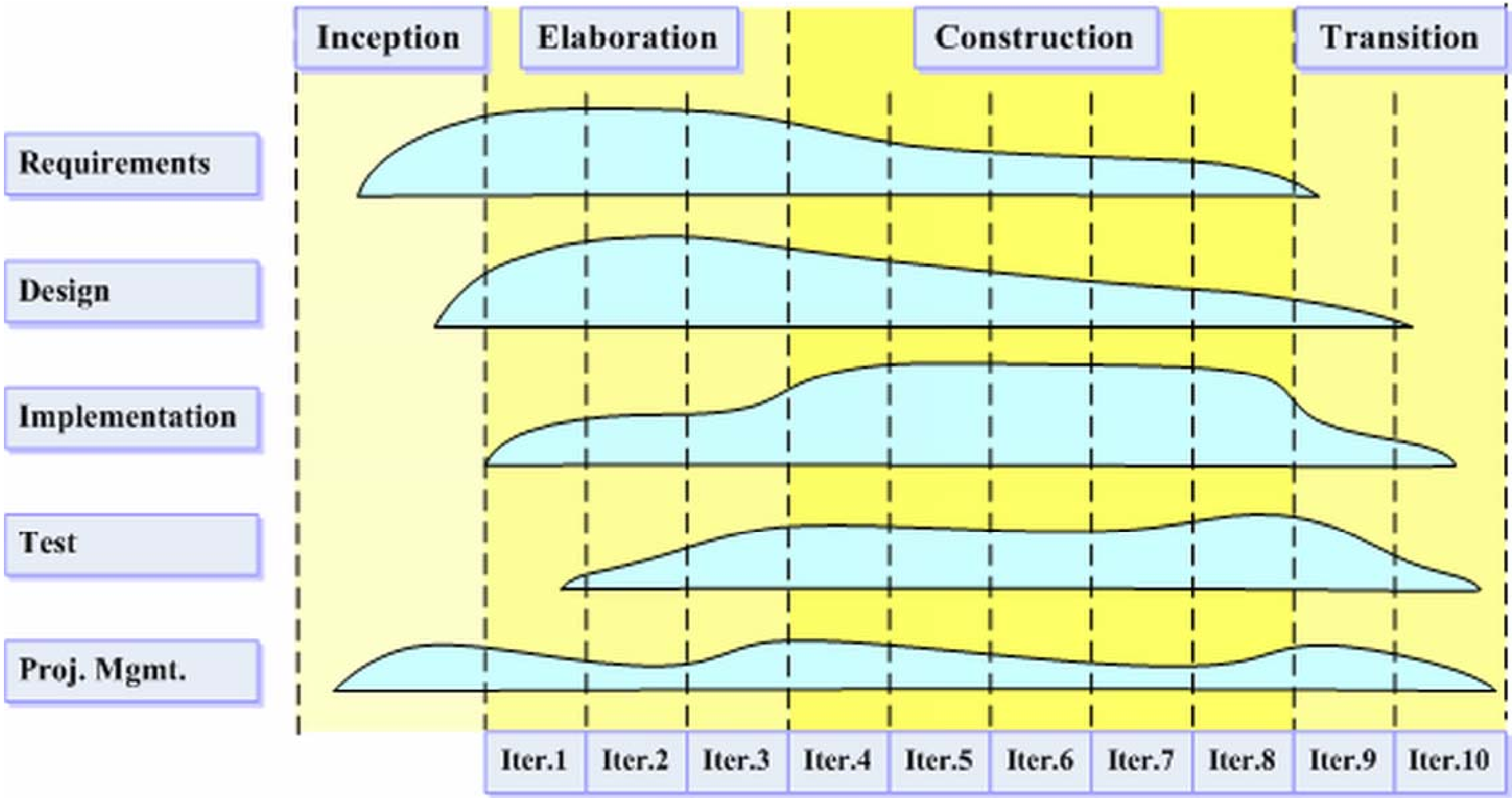
- the entire team owns quality
- test early and continuously
- incrementally build test automation

RUP Lifecycle

- 4 phases divided into a series of timeboxed *iterations*
- Each iteration results in an *increment* (release)
- *Disciplines* (like traditional phases) which happen with varying emphasis in every phase

1. **Inception Phase**
   - Justification or business case
   - Project scope, use cases, key requirements
   - Candidate architectures
   - Risks, preliminary project schedule, cost estimate
2. **Elaboration Phase**
   - Requirements, risk factors
   - System architecture (Executable Architecture Baseline)
   - Construction plan (including cost and schedule estimates)
3. **Construction Phase:** building the rest of the system (longest)
4. **Transition Phase:** deployment, feedback, user training

RUP Lifecycle



RUP Criticism

- “High ceremony methodology”
- Bureaucratic: process for everything
- Slow: must follow process to comply
- Excessive overhead:
  rationale, justification, documentation, reporting, meetings, permission
- Very customizable: can be everything and nothing

But:

- RUP can be used in traditional waterfall style or in agile manner
- Example: dX process
  - Fully compliant instance of RUP
  - Identical to XP

Today's Summary

- **Adaptive** vs. **predictive** Processes
- eXtreme Programming (XP)
  - **Agile** process focused on programming as a team
  - **Short iterations**, as much feed back as possible
- Rational Unified Process (RUP)
  - **Heavyweight** process framework
  - Phases divided into iterations,
    several disciplines happening simultaneously

References:

- Don Wells. Extreme Programming: A Gentle Introduction. 2009. http://www.extremeprogramming.org/
- Rational Software. Rational Unified Process: Best Practices for Software Development Teams. White Paper TP026B. 2001. http://www.ibm.com/developerworks/rational/library/content/03July/1000/1251/1251_bestpractices_TP026B.pdf

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Quiz

1. Describe 3 differences between adaptive and predictive processes.
2. Explain 5 of the XP best practices.
3. What are the main characteristics of the RUP lifecycle?